THE INTERNATIONAL AERONAUTICAL CONFERENCE.

By A. LAWRENCE ROTCH (dated May 31, 1898).

The second meeting of the International Aeronautical Committee (which was appointed by the Paris Meteorological Conference of 1896) was held at Strassburg, Germany, March 31 to April 4, inclusive. Besides the President, Professor Hergesell of Strassburg, and the Secretary, M. de Fonvielle of Paris, there were present the following members of the committee: Messrs. Cailletet and Besançon of Paris, Assmann and Berson of Berlin, Erk of Munich, Rykatcheff and Kowanko of St. Petersburg, and Rotch of Boston, U. S. A. Regrets were sent to Messrs. Hermite and Violle, whom illness detained, and thanks were tendered to those governments and friends of science who proposed to search for André, a member of the committee. A number of physicists, meteorologists, and aeronauts were present as guests. The welcome of the German Government was extended by Von Schraut, Minister of Finance for Alsace-Loraine, who summarized the results achieved in exploring the atmosphere, and predicted a brilliant future. Professor Windelband, Rector of the University of Strassburg, emphasized the importance of these researches for the progress of humanity as well as for science. M. de Fonvielle replied for the committee.

The discussion of the provisional programme was then begun, with the questions relating to the *ballons sondes*. It was agreed that the introduction of a mechanical ballast discharger was necessary, and that all precautions should be taken to prevent derangement of the instruments; the stoppage of the clockwork was attributed to the contraction of the plates carrying the pivots, from the effect of great cold. As regards the calculation of the ascensional force of balloons and the influence of the temperature of the gas it was resolved that—

For each unmanned ascent the weight of the aerostatic material and the ascensional force at the start should be measured, and during the whole voyage the true temperature of the gas should be recorded.

Since the study of the meteorological conditions of the air in a vertical line is important it was considered advisable, in certain cases, to limit the length of the voyage by emptying the balloon automatically.

The instrumental equipment of *ballons sondes* was first considered. M. Teisserenc de Bort presented a report on the determination of height by the barometer.

Drs. Assmann and Berson said that the usual methods gave considerable errors, and they recommended the calculation of the height by successive strata, applying a correction for the change of temperature of the lower stratum during the ascent. The Conference decided that—

All nations should adopt the same formula of reduction, whatever method might be chosen ultimately.

M. Teisserenc de Bort analyzed the errors of the aneroid with respect to the mercurial barometer, but in regard to the latter it was pointed out by Dr. Berson that the mercurial column only represents the atmospheric pressure at the moment when the balloon has no vertical velocity. It was resolved that—

Simultaneous observations should be executed at the different stations, and that the instruments should be controlled by taking them in manned balloons. Besides this, the instruments ought to be interchanged among the different stations in as short a time as possible.

The determination of the temperature of the air in *ballons sondes* was introduced by a report of M. Teisserenc de Bort. Dr. Hergesell remarked that the temperature of the air varied so rapidly that it was necessary to apply a correction-formula which he had developed in the Meteorologische Zeitschrift, December, 1897. M. Cailletet exhibited a thermometer of his invention, which had for its bulb a spiral silver tube soldered to a glass tube, both being filled with the liquid toluene. He stated that it acquired the surrounding temperature in fifteen seconds. M. Teisserenc de Bort exhibited a self-recording thermometer, having a thin blade of german silver fixed in a frame of Guillaume's invariable steel. This instrument takes the temperature of the air rapidly (9° F. in fifteen seconds) and it is not affected by shocks. The ventilation in a balloon is secured by a fan driven by a weight on a wire which falls 5,000 feet in an hour and a half. Drs. Hergesell and Assmann described their attempts to construct a sensitive metallic thermometer, which the latter thought might be ventilated by the agitation of the air through a jet of liquid carbonic acid, but M. Cailletet pointed out that at low temperatures the tension of carbonic acid is too slight to produce ventilation. Dr. Berson remarked that in his high ascent, the upper clouds, at an altitude of 24,000 to 29,000 feet, radiated upon the instruments in the same way as does the surface of the earth at a moderate height. As a result of the discussion it was resolved—

(1) The rapidity of the thermometric variation is so great in *ballons sondes* that to record it thermometers must be employed which have much less thermal inertia than those hitherto employed, and (2) an efficient ventilation of the thermometers is indispensable.

The testing of thermometers at temperatures below those to which they would be exposed in *ballons sondes* was advised, and Dr. Erk described the apparatus of Dr. Linde, of Munich, for the production of a considerable quantity of liquid air. This means of refrigeration enables temperatures lower than 200° C. below zero to be obtained. The Conference recommended that—

Before the ascensions of *ballons sondes* the instruments be verified by varying the temperature and pressure under conditions similar to those to which they would be subjected in the atmosphere.

The equipment of manned balloons was next considered. Some remarks of Dr. Berson on the difficulty of reading a mercurial barometer, owing to the continual oscillations of the mercury, led to the following resolution:

During ascents, the mercurial barometer is the standard instrument for the comparison of aneroids, but for its observations to be trustworthy the acceleration must be zero; it is evident that this condition is fulfilled when the trajectory traced by the self-recording aneroid is horizontal.

In consequence of the statement that it was possible to verify the instruments by reproducing the curves traced by them, the Conference advised that—

There should be reproduced in the laboratory, with the aid of pneumatic and refrigerating apparatus, similar curves to those traced by the barometer and thermometer during balloon ascents.

Further discussion followed as to the methods of obtaining the height of the balloon. M. Cailletet described his apparatus for automatically photographing together, from time to time, the ground vertically below the balloon and the face of an aneroid barometer. From a map the route of the balloon as well as its true altitude are determined; the pressure is deduced from the barometer, and thus the law connecting atmospheric pressure with altitude can be studied. Photographs have been taken from a balloon 7,000 feet high which was moving 40 to 60 miles an hour. The accuracy of these measures was said to be within $\frac{1}{250}$ of the height. It is proposed to photograph a mercurial barometer in the same way. The Conference recommended the use of M. Cailletet's apparatus for both manned balloons and *ballons sondes*. The determination of the height by observations at the ground was brought to the attention of the Conference, and especially the "dromograph," invented by MM. Hermite and Besançon, for automatically registering the azimuths and angular altitudes observed, and the heliometer used by Dr. Kremser, of Berlin, for measuring the apparent diameter of the balloon.

Dr. Erk called attention to the fact that in the case of a large difference of temperature between the wet and dry bulbs of the aspiration psychrometer, the wet bulb always

had in its immediate neighborhood a warmer body, which is the interior cylinder surrounding it. The resulting error may be avoided by covering the interior cylinder with muslin, so that the dry bulb is protected by a cylinder having a temperature, t, and the wet bulb by a cylinder having a temperature, t'. The Conference thought it necessary that—

The instrumental equipment of manned balloons should be uniform, so far as possible. A recommendation has been made in regard to the barometers; concerning thermometers, the opinion is expressed that the aspiration psychrometer placed at the proper distance of at least 5 feet from the basket is the only instrument which should be employed in manned ascents. Simultaneous comparisons with the sling thermometer are recommended.

Drs. Berson and Hergesell urged the importance of simultaneous ascents in the different countries when a center of barometric depression existed over the European Continent. From a purely meteorological point of view the manned ascents have an importance which the *ballons sondes* do not, because the temperature of these high regions can have no influence on the meteorological elements near the surface of the earth. M. de Fonvielle, however, insisted upon the interest of deducing experimentally, from thermometric measures at a very great elevation, the temperature of the supra-atmospheric medium. He called attention to the possibility of choosing in this way between the kinetic theory of gases, which supposes a temperature of 273° C. below zero, and Fourier's theory which assumes that the temperature of space above the atmosphere is near that of the minima observed in the polar regions of the earth.

Future international balloon ascensions were next considered. It was deemed advisable that—

For each *ballon sonde* an instrument should be provided to serve as a basis of comparison with perfected instruments whose construction may change from one ascent to another on account of the improvements which may be attempted.

It was announced that in the next international ascent of *ballons sondes* Austria, Italy, and Belgium would participate, besides the countries which had already cooperated. This ascent was appointed for the beginning of June with certain stations of the international system to be chosen as starting points. The balloons should be as nearly as possible like those approved by the Conference, and the directors of the various meteorological systems were requested to institute observations on the days of the ascents according to the principles fixed by the President of the Committee. It was recommended that—

For the simultaneous study of the lower air strata, the observations from high stations be used, and especially those from kites and kite balloons.

After a presentation of various methods for effecting the safe landing and the recovery of *ballons sondes*, resolutions looking to these ends were adopted. Balloons may be protected against explosion caused by atmospheric electricity by covering their interior surface with a solution of potassium chlorate, which renders the fabric a conductor. For the measurement of atmospheric electricity the methods of Le Cadet, Börnstein, and André are recommended, especially the former.

Mr. Rotch read the report which he had been requested to prepare on the use of kites at Blue Hill Observatory, U. S. A., to obtain meteorological observations. He showed the advantages which kites possess over balloons up to heights exceeding 10,000 feet, whenever there is wind.

A letter from the Chief of the Weather Bureau explained the proposed use of kites to obtain data for a daily synoptic weather chart over the United States at the height of a mile or more. M. Teisserenc de Bort is equipping a kite station at Trappes, near Paris, after the model of Blue Hill, and General Rykatcheff stated that an anemograph of his invention was being raised with Hargrave kites at St. Petersburg. The Conference recommended the use of the kite in meteorology, and expressed the wish that all central observatories should make such observations, which are of prime importance for meteorology. On account of the favorable position of Mounts Cimone and Etna it is desirable that at the observatories on these mountains kites should be used in connection with the international balloon ascensions. The Conference expressed the desire that the chief observatories should be provided with the kite balloon of von Parseval and von Siegsfeld (see description hereafter) in order that there may be a certain number of permanent aerial stations, and following the idea of M. Tacchini it is hoped that kite balloons will be used in Italy on Mounts Viso and Etna, and also at the Military Park at Rome.

The following new members of the Committee were elected: M. Teisserenc de Bort and Prince Roland Bonaparte, of Paris, Professor Hildebrandsson, of Upsala, Professor Pernter and Lieutenant Hinterstoisser, of Vienna, Captain Moedebeck, of Strassburg, and Lieutenant von Siegsfeld, of Berlin. The next meeting was appointed for 1900, at Paris, during the Universal Exposition.

The Committee had the opportunity of witnessing two trials of the captive kite balloon, invented by Lieutenants von Parseval and von Siegsfeld, and constructed by Riedinger, of Augsburg, at a cost of $1,000, for Professor Hergesell and Captain Moedebeck. Although this form of balloon is used in the German army for reconnoitering, it was now employed for the first time to lift self-recording meteorological instruments. The cylindrical balloon is so attached to the cable that its upper end inclines toward the wind, which thus raises instead of depressing it, as in the case of captive spherical balloons. The wind enters an auxiliary envelope at the lower extremity and maintains the cylindrical form, notwithstanding any loss of gas. This wind bag also serves as a rudder, while lateral wings prevent rotation about the longer axis. The Strassburg balloon has a diameter of 14.7 feet, a length of 55.7 feet, and a volume of 7,770 cubic feet. The gas bag is varnished linen, and was filled with a mixture of hydrogen and coal gas. The weight of the balloon complete is 230 pounds, and the steel cable holding it weighs 2 pounds per 100 feet. The azimuth, altitude, and traction of the cable are recorded by a dynamometer invented by Riedinger. The meteorological instruments are contained in a basket (with open ends, through which the wind blows, but covered elsewhere with nickeled paper as a protection against insolation), suspended some 40 feet below the balloon. The self-recording instruments were a barometer and thermometer of Richard and a Robinson anemometer recording electrically. Although the kind of gas employed was hardly sufficient to lift the unnecessarily heavy basket and its contents, weighing 80 pounds, yet the trials made in rainy and windy weather were fairly successful, and a height of about 1,000 feet was reached. Without instruments the balloon had remained for several days above the city, and had withstood a gale.

The Committee also saw a hastily organized ascent of the *ballon sonde*, "Langenburg," which is a silk balloon of about 14,000 cubic feet capacity. When filled with coal gas it had an initial ascensional force of about 440 pounds in excess of its own weight and that of the instruments, contained in a cylindrical basket, which was open at top and bottom for ventilation, and was also covered with nickeled paper. They comprised a barometer and thermometer of Richard, and the metallic thermometer of Teisserenc de Bort, which all recorded on smoked paper. Owing to the premature launch of the balloon the ballast was left behind, and the escape of gas, owing to the too rapid ascent, prevented a great height from being reached. The balloon rose at about 6 p. m. with a velocity of nearly 23 feet per second, and disappeared in the strato-cumulus clouds in five minutes. It attained an alti-

tude exceeding 6 miles, and fell about 60 miles southeast of Strassburg, where it was found the next day. Unfortunately the shock caused by the breaking loose of the balloon stopped the clocks of the thermographs and prevented records of temperature from being obtained.

An official account of this Conference will be published in the French and German languages, together with the special reports prepared by the experts.

THE EIGHTH GENERAL MEETING OF THE GERMAN METEOROLOGICAL SOCIETY.

By A. LAWRENCE ROTCH.

The triennial meeting of this society, which was held at Frankfort on the Main this year between April 14 and 16, was attended by about twenty-five members. In the absence of the president, Prof. Dr. von Bezold, the vice-president, Prof. Dr. Neumayer, director of the Deutsche Seewarte, presided, and delivered an address on the progress of meteorology during the past twenty-five years, in which he advocated antarctic exploration as a means of advancing meteorology and terrestrial magnetism. Prof. Hergesell summarized the proceedings of the recent International Aeronautical Conference at Strassburg; Dr. Bergholz, of Bremen, spoke on the form of meteorological annuals and advocated the form adopted by the Potsdam Observatory; Mr. Polis, of Aix-la-Chapelle, discussed the circulation in areas of high and low pressure; Prof. Dr. Börnstein, of Berlin, with the aid of a model showing the monthly and daily periods, described the temperature conditions of that city, remarking that the mean of the daily extremes differed only 0.035° C. from the mean of the twenty-four hours; and Dr. L. Meyer, of Stuttgart, spoke on the daily changes of cloudiness in Hohenheim. Dr. Erk, of Munich, discussed the movements of the air in cyclones, as exemplified in Bavaria; Prof. Dr. Hellmann, of Berlin, recommended at secondary stations exposing the thermometers with no screens outside of the windows, but this was dissented from by other speakers; Prof. Hergesell described a sensitive recording metallic thermometer, constructed by M. Teisserenc de Bort. Dr. Knipping, now in charge of ocean meteorology at the Deutsche Seewarte at Hamburg, proposed a more extensive publication of extracts from ships' logs, which should help to equalize the much greater amount of data published for the land; and Prof. Max Möller, of Brunswick, discussed the relation of the pressure distribution to the horizontal temperature differences and friction. Prof. Dr. Sprung, of the Potsdam Observatory, described two of his new instruments; one was for taking, automatically and simultaneously, at two stations a series of photographs of clouds, in order to determine their height; the other was a rain and snow gauge, which weighed the precipitation and recorded it on the principle of his balance barograph. Prof. Dr. van Bebber, of Hamburg, in an analysis of the duration of sunshine in North America, stated that the amount of sunshine increases rapidly toward the south, as in Europe, and reaches a maximum in Arizona. Like Europe, the mountains receive the most morning sunshine, but, unlike Europe, the annual maximum in America occurs in the north in July and in the south in June. The speaker inferred that the characteristics of the northern and southern people are to be attributed to climatic conditions, and especially to the duration of sunshine. Prof. Dr. Neumayer exhibited charts of terrestrial magnetism and pointed out where observations were desired; Dr. Gerstmann, of Berlin, said that the importance to fruit growers of being able to predict frosts at night demanded that suitable dew-point tables be prepared.

No reports of the proceedings were published, except in the newspapers, but it is probable that many of the papers will appear in the Meteorologische Zeitschrift. Prof. Dr. Neumayer, having resigned his position as vice-president of the Society, which he helped to create in 1883, was chosen an honorary member. The same honor was conferred on General Rykatcheff, director of the Physical Central Observatory at St. Petersburg. The following meteorologists were elected corresponding members of the society: Paulsen, of Copenhagen; Snellen, of Utrecht; von Konkoly, of Budapest; Hepites, of Bucharest; Rotch, of Boston; Pernter, of Vienna; Sapper, of Guatemala; and Lancaster, of Brussels.

CLIMATIC DATA BEARING UPON THE CULTURE OF THE DATE PALM.

By A. J. HENRY, Chief of Division.

Mr. Alfred A. Wheeler, of 1220 Jackson street, San Francisco, Cal., writes to the Chief of Weather Bureau, under date of May 20, 1898, requesting certain climatic data for Arizona for use in a comparative study of the climates adapted to the culture of the date palm. Mr. Wheeler states, among other things, that—

It is not sufficient for date culture that one should know the minimum temperature of any month. The facts of importance are: (1) the minimum, (2) the mean of minima, (3) the times of temperatures at 32° or below. This record for the six months from November 1 to May 1 gives a Night Frost Table that is all sufficient; for everybody knows there is no duration of low temperature lasting into daytime in the horticultural parts of either California or southern Arizona. Similarly, from May 1 to November 1, the converse record, giving the coefficient of heat, is what the date grower will require, viz, (1) the maximum, (2) the mean of maxima, (3) the times of temperature at 90° or above. The date blooms in Arizona and California from April 15 to May 15, according to season and locality, and this Heat Table would cover its whole period from blooming to ripening. As date culture is on the verge of becoming an industry in Arizona and California, both of these tables would be of great value there; and the utility of the frost table would apply equally to Florida, since there, as in California, the growing of citrus fruits is the object of an established commerce. I hope the Weather Bureau will agree with me that it is important to tabulate climatic facts for regions like California, Arizona, and Florida, different from those which are of interest elsewhere, where the forms of horticulture are determined by other conditions.

The information collected for Mr. Wheeler is published herewith for the benefit of readers of the REVIEW.

Table of maximum temperatures at Phœnix, Ariz.

Year.	Month.	Maximum.	Mean maxima.	No. of hours with temperature 90° or above.	Year.	Month.	Maximum.	Mean maxima.	No. of hours with temperature 90° or above.
		°	°				°	°	
1895 ...	August	110	101.4	268.0	1896 ..	October	98	83.3	39.5
1895 ...	September ...	107	97.0	221.0	1897 ..	May	104	93.8	175.5
1895 ...	October	93	85.9	36.5	1897 ..	June	107	98.6	247.5
1896 ...	May	110	89.6	79.0	1897 ..	July	107	103.1	379.5
1896 ...	June	115	105.1	396.5	1897 ..	August	110	102.0	339.0
1896 ...	July	109	100.2	300.5	1897 ..	September ...	102	95.8	173.0
1896 ...	August	108	100.7	323.0	1897 ..	October	100	82.1	22.5
1896 ...	September ...	104	95.5	197.5					

Table of minimum temperatures at Phœnix, Ariz.

Year.	Month.	Minimum.	Mean minima.	No. of hours with temperature 32° or below.	Year.	Month.	Minimum.	Mean minima.	No. of hours with temperature 32° or below.
		°	°				°	°	
1895 ...	November ...	34	44.6	0.0	1897 ..	February	30	39.4	6.0
1895 ...	December ...	23	34.8	72.0	1897 ..	March	31	41.3	1.5
1896 ...	January.....	30	39.2	16.5	1897 ..	April	38	51.6	0.0
1896 ...	February	28	41.1	17.5	1897 ..	November ...	31	44.0	2.5
1896 ...	March	34	48.4	0.0	1897 ..	December ...	23	33.6	56.0
1896 ...	April	38	48.7	0.0	1898 ..	January.....	23	36.5	76.5
1896 ...	November ...	32	55.8	1.0	1898 ..	February	36	43.8	0.0
1896 ...	December ...	33	39.7	0.0	1898 ..	March	33	43.2	0.0
1897 ...	January.....	27	40.5	10.5	1898 ..	April	41	56.8	0.0